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The bioclimatic performance of towns and settlements as defined by Byzantine Building Codes

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Abstract

The Byzantine Building Codes aimed at defining in a very precise manner the way in which settlements and towns were built within the boundaries of the Byzantine Empire. Consequently, they contained rules that defined the front, side and rear distances between buildings of different uses, the number and dimensions of the windows, the depth and distances of the projections, etc. Many of these limitations and rules were mainly derived from issues of sanitation, privacy and views. Nevertheless, in many parts of the Codes, there is reference to the achievement of acceptable daylighting and ventilation conditions.

This primary aim of this paper is to investigate the bioclimatic performance of the built environment, which was shaped based on these building codes, in terms of insolation, shading and daylighting, as well as air circulation and ventilation. The findings of the study will provide information concerning the bioclimatic performance of both the urban open spaces and the interior living spaces of buildings in Byzantine towns and settlements, whose form derived from Byzantine Building Codes.

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1. Introduction

The building codes that were in effect during the period of the Byzantine Empire in its different towns and provinces have been the object of numerous studies. Tourptsoglou-Stephanidou^{1,2} presents in great detail the building codes that defined the production of the built environment, as well as issues directly or indirectly linked

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with it, within the boundaries of the Byzantine Empire, from the Theodosian Code (313 A.D) until the Hexabiblos of Armenopoulos (1345), while Hakim^{3,4} presents in great deal the Treatise of Julian of Ascalon, as well as the various building and urban codes that were in use in the countries and areas around the Mediterranean Basin.

The history, the sources, the books, the content, as well as the basic institutions of the Byzantine building codes, namely the proprietary rights and rights of praedial servitude², are thoroughly analysed by the afore-mentioned authors and are thus completely excluded from the present study. Nevertheless, a synopsis of the Byzantine building codes, from which data are drawn and analysed in this paper is presented in Appendix A.1.

2. Methodology and Assumptions

The analysis is based on the analysis and codification of the Byzantine urban and building legislation presented by V. Tourptsoglou-Stephanidou^{1,2} and mainly involves Istanbul, which was the capital of the Byzantine Empire, as well as towns in other, more southern parts of the Empire, where local variations of the Building Codes existed. The basic codes from which plans and sections are drawn^{1,2} are Zenon's Edict (474-491) and Julian of Ascalon's Treatise (532-533). These are used to draw typical sections, which are qualitatively assessed in terms of air circulation and ventilation, and to construct three-dimensional models, which are analysed in terms of insolation, shading and daylighting with the Ecotect Analysis software.

The sections and the models are constructed in metric units (meters and centimeters), which are derived from the conversion of the byzantine foot. The metric system in the Byzantine Empire was based primarily on the foot and secondarily on the cubit. The dimensions of the foot varied over time, while there are also differences in the way in which the foot is connected with the cubit. Tourptsoglou-Stephanidou^{1,2} based her analysis on the foot of 31.23 cm and the cubit, which is equal to 1.5 times the foot, namely 46.8 cm. Consequently, this data is used for the present study, as well.

Two typical street configurations are analysed: two-storeyed buildings facing a street with a width of 10 feet (3.123 m), which is the distance set by the Theodosian Code and the Treatise of Julian of Ascalon and of 12 feet (3.74 m), which is the distance set by Zenon's Edict.^{1,2} (Fig. 1) The buildings have sloped roofs with eaves projecting by 1 foot (0.312 m). While this may have been true for Istanbul, buildings in the Middle East are more likely to have had flat roofs.

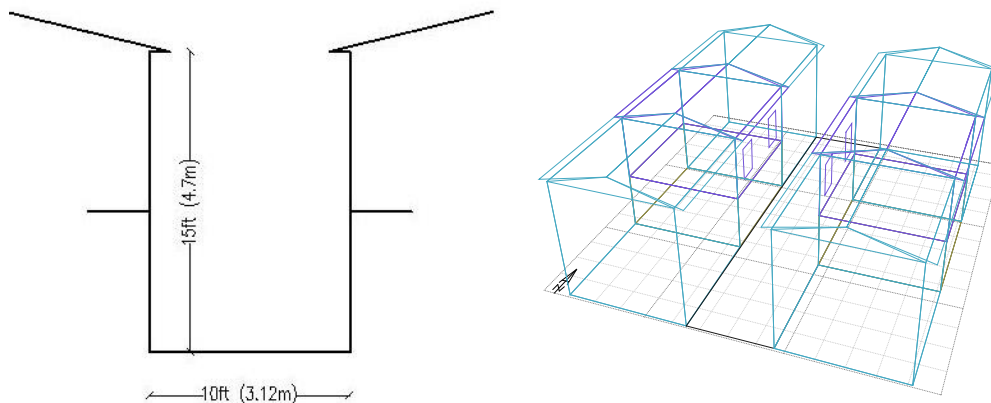


Fig. 1. Typical dimensions for street configurations redrawn after ^{1,2} (a) Street section; (b) Three-dimensional street model.

Another assumption involves the climatic data. As the analysis is mainly based on Zenon's Edict and on Julian of Ascalon's Treatise, climatic data for Istanbul and the wider Gaza area in the Middle East is used for the analysis. It is obvious that present climatic conditions may differ considerably from those prevailing during the 5th and the 6th century A.D., when the codes were written. Nevertheless, sun altitude and azimuth angles, which are used for the

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